THE EFFECT OF THE MINIMUM WAGE ON HOURS OF WORK

An Undergraduate Research Scholars Thesis

by

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ABSTRACT

The Effect of the Minimum Wage on Hours of Work. (April 2015)

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In this paper, I use data from the American Time Use Survey to determine whether there is a causal relationship between the minimum wage and hours of work. As hiring and firing decisions are costly, it may be the case that the total level of employment is more readily reduced by cutting back on workers' hours rather than laying off workers in a way that would affect the unemployment rate. If so, this would suggest that empirical inference regarding the effect of the minimum wage on employment should account for the possibility of a reduction in employment that occurs partially through reduced hours of work. Using standard linear regression analysis, I estimate that a 10% increase in the minimum wage is associated with a 1.67% decrease in hours of work for workers earning less than $12 per hour. Difference-in-differences analysis leads to the conclusion that the July 2007 federal minimum wage increase caused hours of work to decrease by approximately 4.3 hours per week.

SECTION I

INTRODUCTION

The minimum wage has recently been a hotly debated political issue in the U.S., resulting both in calls to raise the federal minimum wage significantly and in actual increases in states and localities to minimum wages as high as $15 per hour. Aside from boosting earnings for low-wage earners, we might look to the minimum wage as a method for ensuring that all workers can achieve a certain standard of living. As with many well-intentioned policies, however, there is reason to believe that increasing the minimum wage might produce unintended consequences that harm the workers who need help the most. In this paper, I investigate the presence of one such consequence of the minimum wage: a reduction in hours of work for low-wage earners.

The standard economic reasoning for why we might expect such adverse effects is similar to the intuition behind why price controls cause inefficiencies in competitive markets. If the price of labor is forced above its equilibrium legally, textbook economics predicts that this will cause firms to hire less labor while causing more individuals to seek work. Some low-wage earners may lose their jobs altogether, and more productive workers may now compete for jobs with those who are unemployed. Additionally, it makes sense intuitively that firms would let their least productive workers go first, in which case this policy would cause the most immediate harm to those who are most in need.

Interestingly given the solidity of this theory, this unemployment effect has not been found to occur robustly in a significant portion of the literature on the subject. Much of the recent research

on this topic has been motivated by a well-publicized 1994 study by Card & Krueger that found that a higher minimum wage actually increased employment in the fast food industry in New Jersey. There has been significant discussion back and forth in the two decades since then, and economists using varying methodologies have reached a variety of conclusions on the issue.

The ambiguity of these results has motivated many economists to investigate how that the minimum wage could affect employment outcomes for low-wage earners without actually causing them to be laid off. For instance, Meer and West (2013) find that the minimum wage reduces employment by decreasing the rate at which new jobs are created. In another approach, Simon and Kaestner (2003) find that the minimum wage has no effect on the fringe benefits offered to low-skilled workers or the quality of their workplace conditions.

Investigating an employment effect of the minimum wage through a decrease in total hours worked, however, is an approach that has not been explored exhaustively in the literature yet. Zavodny (2000) finds no significant effect, while Couch and Wittenburg (2001) find a negative effect and conclude that estimates of the effect of the minimum wage that are based on aggregate employment underestimate the true impact of the minimum wage. However, these studies rely on Current Population Survey (CPS) data, while I use the American Time Use Survey (ATUS). The ATUS is administered by the Bureau of Labor Statistics (BLS) and linked to the CPS, and it contains much more specific data on time use than the CPS. This feature, in addition to others described in Section II, makes the ATUS ideal for analyzing the relationship between the minimum wage and hours of work in particular.

In my paper, I examine data from the ATUS to determine whether the federal minimum wage changes in 2007, 2008, and 2009 had an impact on hours of work for low-wage earners. The results are suggestive of a negative effect of the minimum wage on hours of work. This is borne out by both standard regression analysis and a difference-in-differences estimation.

The rest of the paper proceeds as follows: Section II outlines important features of the data set I use. Section III presents the main takeaways from statistical analysis of the time use data. Section IV summarizes the implications of these results.

SECTION II

DATA AND METHODS

My data set is the American Time Use Survey (ATUS), which is publicly available from the Bureau of Labor Statistics (BLS). To compile the ATUS, the BLS contacts a subset of individuals who have completed the Current Population Survey (CPS) and has them complete a time diary that documents how they spent their time specifically over the course of an entire day. The manner in which each individual spent every minute of their day is reported in the data set along with other standard categorical data and employment information. The ATUS data is also linked to the individuals' CPS responses from about two to five months prior, providing more information about each respondent and creating the potential to analyze how respondents changed between responding to the CPS and responding to the ATUS.

Because compiling the ATUS involves conducting in-depth surveys with respondents, its data is much more specific and presumably more reliable. This circumvents a major drawback of the CPS employment data, which is that many workers simply report that they work 40 hours per week whether that is entirely accurate or not. Another advantage of the ATUS is that I am able to exploit the time gap between an individual's responses to the CPS and his or her responses to the ATUS to analyze what changes occurred between the two surveys. For instance, average weekly hours of work is reported by respondents to both the CPS and the ATUS.

I approach the question of the magnitude of the effect of the minimum wage on hours of work using linear regression analysis that controls for characteristics such as race, gender, and level of

education and includes dummy variables for state and year. In attempting to identify a causal relationship between the minimum wage and hours of work, I also have an opportunity to use difference-in-differences methodology. Here I compare average hours of work on either side of the July 2007 federal minimum wage change for those in states where the federal minimum wage is binding to the averages for those in states with a state minimum wage that is higher than the federal level. My methodological approach is considerably informed by that of Clemens and Wither (2014).

SECTION III

REGRESSION AND DIFFERENCE-IN-DIFFERENCES ANALYSIS

Ordinary Least Squares Linear Regression

I regress the natural log of average weekly hours worked on various individual characteristics as well as time and state fixed effects:

$$\ln(\text{weeklyhrs}) = \beta_1 \ln(\text{real minimum wage}) + \beta_2 \text{age} + \beta_3 \text{age}^2 + \beta_4 \text{sex} + \beta_5 \text{edulevel} + \beta_6 \text{race} + \beta_7 (\text{year x month}) + \beta_8 \text{state} + \varepsilon \quad (1)$$

Using the log of weekly hours as the dependent variable enables the interpretation of each coefficient as a percentage change in weekly hours. The interaction variable for time fixed effects and the variable for state fixed effects significantly decrease the concern that any results of the regression are driven by trends in certain months or in certain states. This is particularly important because the minimum wage changes essentially overlapped with the recession that took place in the U.S. during this time period. Neglecting to include these variables might raise concerns that the regression's output is driven by the recession's trends during the months of implementation of minimum wage increases or by the recession's harsh impact on certain states over others. The results of this regression are shown in Table 1.

Table 1. Regression Coefficients

Variable	β Coefficient	Standard Error	|t|
Ln(real MW)	-.167	.070	2.39
Age	.06	.002	30.95
Age^2	-.0007	.00003	28.90
Male	.166	.010	15.89
High school diploma	.178	.014	12.72
Some college	.115	.016	7.09
Associate degree	.144	.018	8.03
Bachelor's degree	.073	.021	3.44
Advanced degree	.092	.034	2.67
Black	.064	.014	4.67
Hispanic	.145	.019	7.53
Asian	.002	.023	0.10
Other non-Whites	.026	.028	0.94

The results in Table 1 result from running the linear regression solely on individuals who are employed, work more than zero hours per week, and earn a wage of less than $12 per hour, with n = 18293. Standard errors are robust and clustered by state. Narrowing the sample down to only those individuals from the first sample who work part-time (defined as working 35 hours or fewer per week) causes many of the reported effects to diminish slightly and become less statistically significant, which can be attributed to the reduced sample size of 8488.

Many of the estimated coefficients conform with broad trends in the U.S. labor market. For instance, males tend to work more hours all else equal, and more education tends to lead to more hours worked but at a diminishing rate. The regression reports at a statistically significant confidence level that both Blacks and Hispanics work more hours than Whites, although the amount Asians and other non-Whites in the sample is too low to estimate statistically significant effects for these races.

The primary coefficient of interest can be interpreted as indicating that a 10% increase in the real minimum wage is associated with a 1.67% decrease in hours of work, and this effect is significant at a 95% confidence level. This estimated effect is certainly large enough to suggest that the effect of the minimum wage on hours of work is a topic that is worthy of more careful consideration that it has received in previous debates and research on the minimum wage.

Indeed, a federal minimum wage of $10.10 was proposed in the 2014 U.S. State of the Union address. This would represent about a 40% increase from the current federal minimum wage of $7.25 per hour. Taken at face value, then, the above regression would predict a 6.68% reduction in hours of work for a worker who earns exactly the minimum wage in the U.S. The average worker in the regression's sample earns $8.60 per hour and works about 33 hours per week. For the average worker, then, the magnitude of the effect suggests that hours of work would decrease by about 1 hour per week following the minimum wage change.

It is informative to run a regression that is similar to the one above while including a categorical variable that interacts each worker's North American Industry Classification System (NAICS) code with the log of the real minimum wage. This gives further insight into which industries in particular see changes in hours of work as the minimum wage changes. The industry-specific coefficients of a regression that includes this interaction are reported in Table 2.

Table 2. Minimum Wage x Industry Coefficients

Industry	β Coefficient	Standard Error	|t|
Agriculture, Forestry, Wildlife	-.078	.086	0.91
Mining	.079	.077	1.03
Utilities	-.087	.081	1.08
Construction	-.06	.07	0.87
Manufacturing	-.026	.074	0.35
Wholesale Trade	-.040	.077	0.53
Retail Trade	-.120	.074	1.62
Transportation and Warehousing	-.084	.76	1.10
Information	-.143	.076	1.87
Finance and Insurance	-.055	.076	0.72
Real Estate	-.111	.078	1.42
Professional/Technical Services	-.107	.075	1.45
Management	-.010	.127	0.75
Admin. Support	-.100	.075	1.32
Education	-.263	.080	3.29
Health Care	-.106	.077	1.38
Arts and Entertainment	-.187	.081	2.32
Accommodation and Food Services	-.124	.076	1.63
Other Services	-.244	.074	3.29
Public Admin.	-.081	.079	1.03

It is important to remember that the coefficients reported in Table 2 are not simply the coefficients for regressing hours of work on industry, but the coefficients for regressing hours of work on an interaction between log of real minimum wage and industry. Therefore, they indicate for which industries the minimum wage seems to affect hours of work the most. Many industries neglect to produce effects that are statistically different from zero. Some of these, such as Mining, likely occur because there is a very small amount of workers from these industries in the sample. Others, such as Health Care, may be explained by the fact that these industries are

generally dominated by workers earning wages that are high enough to be unaffected by the current and prior levels of the minimum wage in the U.S.

Information, Education, Arts and Entertainment, and Other Services all return relatively large coefficients that are statistically significant. Additionally, Retail Trade and Accommodation and Food Services return coefficients that are fairly large and close to being significant at a 10% confidence level. While Food Services may be expected to be an industry with a very large proportion of workers earning the minimum wage, this does not necessarily mean that its workers would face the largest reductions in hours of work due to minimum wage increases. In each of these industries, there is an abundance of workers that earn low wages, work part-time, and do not intend to stay at their present job for an extended period of time. This lends creedence to the theory that the negative association between the minimum wage and hours of work is indeed driven primarily by the least productive workers.

Difference-in-Differences Regression

Furthermore, I narrow the sample down to only observations that occur within 23 days of the federal minimum wage change that occurred on July 24, 2007. This change in particular raised the federal minimum wage from $5.15 to $5.85, so I create an indicator variable that labels individuals as "bound" if they live in a state with a minimum wage that is lower than $5.85 and "unbound" if not. Comparing the average hours worked per week for each group before and after the minimum wage change reveals that unbound workers increased weekly hours by 1.6 hours on average while bound workers decreased weekly hours by 2.7 hours. Thus, the conclusion to be

drawn from the difference-in-differences estimation is that the increase in the minimum wage caused a 4.3 decrease in hours worked per week.

This effect is significant at a 7% significance level. It also requires the assumption that the groups of workers do not change in unobservable ways during the same time period as the minimum wage change and that the only significant difference between the bound workers and the unbound workers is their exposure or lack of exposure to a higher minimum wage. These assumptions seem to be borne out in the data, as observable characteristics do not vary considerably between the before and after groups or between the bound and unbound groups. For instance, the percentage of males in the sample before the federal change is not different from the percentage of males in the sample after the change at a level that is statistically significant. Additionally, the racial breakdown of the before and after samples is approximately equivalent by percentage, and the same is true for education level. Given that these characteristics do not appear to be systematically biased in a certain way, it would be reasonable to conclude that unobserved characteristics such as cognitive ability and drive are just as randomly distributed.

The average real minimum wage (in 2011 dollars) faced by the workers in the sample before the federal change is $6.93, while that faced by the workers in the sample after the federal change is $7.15. For workers that were bound by the federal change in particular, the average minimum real minimum wage went from $5.60 to $6.34, while for unbound workers the average remained essentially unchanged, going from $7.55 to $7.56. It is encouraging that the minimum wage faced by the average worker did indeed increase on July 24, 2007 but that this change is driven entirely by workers in states that were bound by the federal minimum wage change.

SECTION IV

CONCLUSION

The results from the above statistical analysis suggest that the minimum wage may adversely affect low-wage workers through avenues other than a reduction in the probability of employment. Public discourse on the efficacy of the minimum wage should be adjusted to account for this nuance, and economists may find great value in investigating more closely how and why hours of work change for unproductive workers in response to changes in the minimum wage.

An important question that may be answered by further research is the extent to which managers consciously limit certain workers' hours and their methods for doing so. It could be the case that some of the reduction in hours can be attributed to an income effect induced by the higher wages brought about by the minimum wage. In other words, reductions in hours may be voluntary in part because the higher wage enables workers to earn the same income while working fewer hours than before. This would be an unintended consequence of the minimum wage in any case, but the origin of reductions in hours is likely of interest to policymakers who are interested in raising the living standards of the poor.

The ATUS also offers the potential for analyzing time use trends in low-wage earners that have not been thoroughly researched before. There is some anecdotal evidence that the quality of shift timing has decreased for many workers with the advent of computerized systems that allow managers to schedule shifts precisely based on workers' availability. Further research could determine whether workers, particularly low-wage earners, are now more likely to work multiple

shifts in a day or to work late-night shifts. In addition to analyzing broad trends in quality of shift timing, further research could determine whether any changes in shift quality have coincided with increases in the minimum wage. Regardless of whether this is the case or not, however, the large state and local minimum wage increases that are currently taking place should also create ample opportunity for economists to refine our understanding of the impact of the minimum wage on standard outcome measures such as the probability of employment.

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